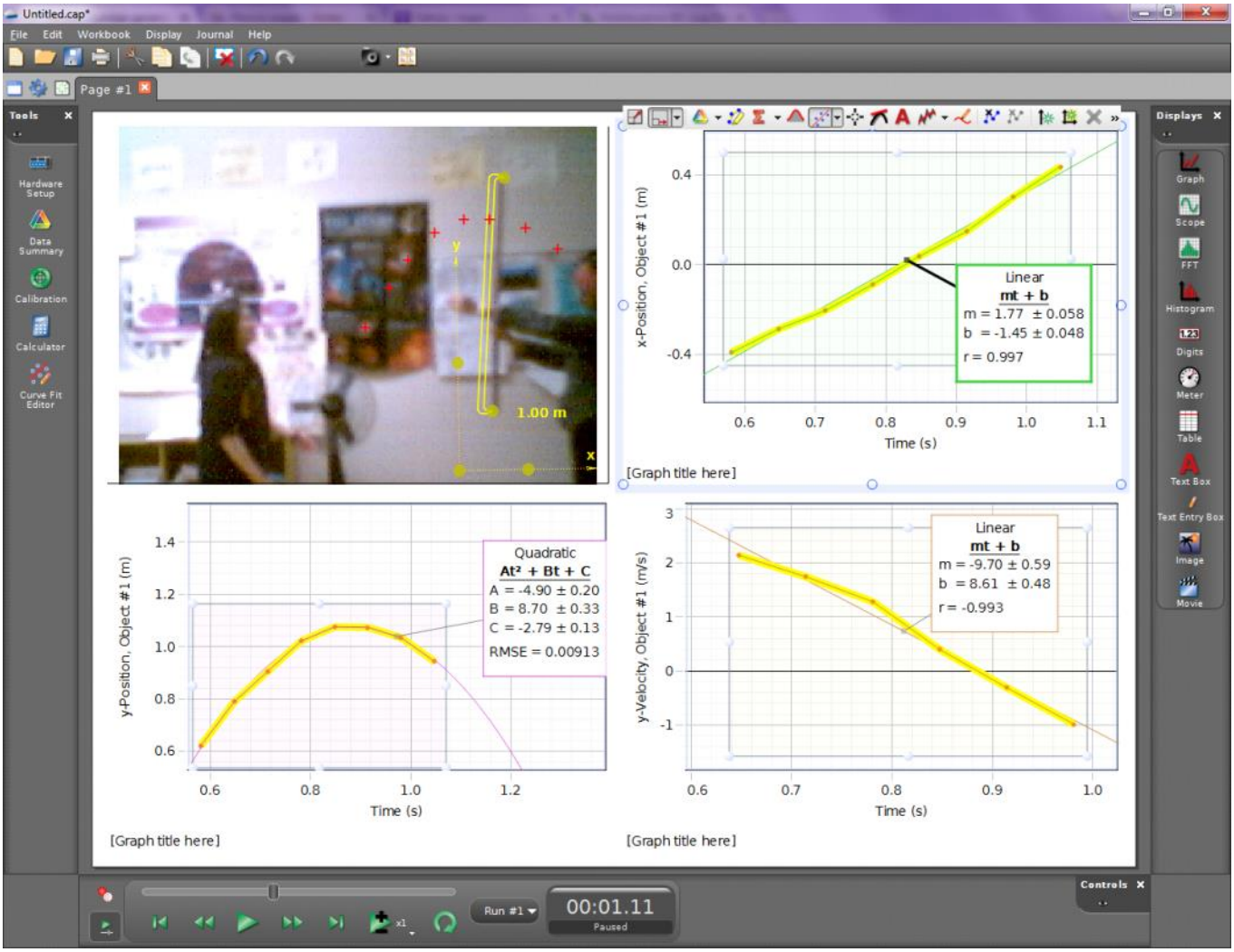
lab: screenshot:



with x-t, y-t, vy-t graphs with equations
in your analysis, rewrite the equations with proper units and variables
so instead of y=mx+b write
s_x = (1.77m/s +/- 0.06m/s)t + 1.45 m+/- 0.05

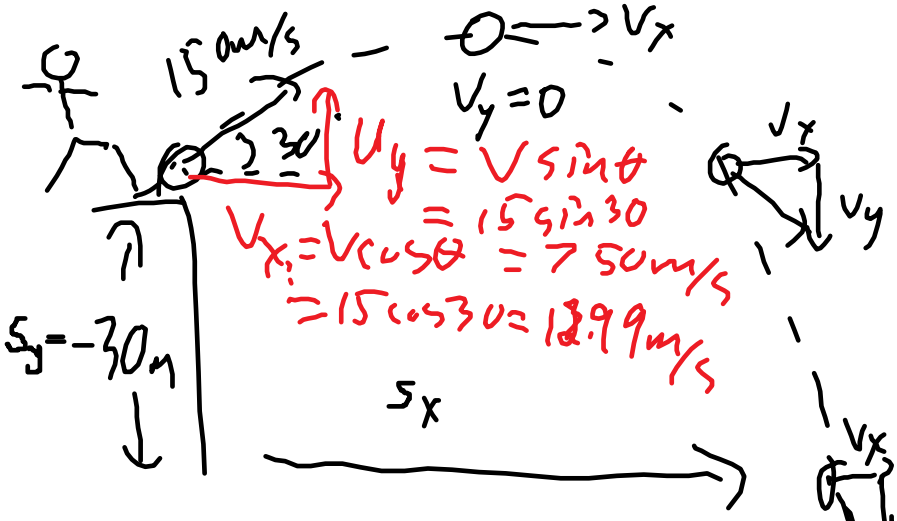
$s_x = (1.77\text{m/s} +/- 0.06\text{m/s})t + 1.45\text{ m} +/-0.05\text{m}$

1 sf

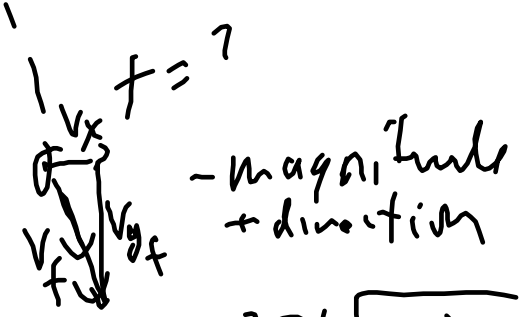
include a % deviation from theory (9.81m/s^2) calculation, conclusion and sources of uncertainty
upload to managebac?

you kick a soccer ball off a 30.0 m high cliff with a speed of 15.0 m/s, 30.0º above the horizontal. determine

a) x and y components of the initial velocity



a) time to hit the ground



- magnitude + direction

$s_y = \frac{1}{2}gt^2 + v_y t$

$-30 = -4.905t^2 + 7.50t$

$0 = -4.905t^2 + 7.50t + 30$

$t = \frac{-7.5 \pm \sqrt{7.5^2 - 4(-4.9)(30)}}{-9.81}$

$t = 3.35\text{s}$ or -1.8s

v=at+u
$t_{up} = (v-u)/a = (0-7.5)/-9.81 = 0.7645$
$s_{up} = (v^2-u^2)/2a \quad (7.5\text{x}7.5)/(2\text{x}9.81) = 2.867\text{ m}$
$s = 1/2at^2$

$s_{up} = (v^2-u^2)/2a$ $(7.5x7.5)/(2x9.81)=2.867$ m
$s = 1/2at^2$
t_{down} = Sqrt(2x(30+2.867)/9.81)=
2.588573653113678
total time = 2.58857+0.7645=3.35307

a) sx when it hits the ground.

$s_x = v_xt$ = 12.99x3.35307=43.55638
43.6 m away from the cliff.

compare with kicking the soccer ball horizontally.

vx = 15.0m/s uy = 0 horizontal
$sy = 1/2gt^2 + uyt$
t = Sqrt(2x30/9.81)=2.47309683414749
sx = 15x2.473097=37.096455
=37.1m much less than when kicked up at 30º.

it is going faster in the x direction but it is in the air less time.

10minutes work this out

Mandatory for pass:
on level ground, what is the angle that gives

the furthest range of the projectile?
What if the launch point is elevated?
prove it mathematically

p64 General Problems 51-59 odds
don't forget about Q45 - use trig identity to solve

What is the equation relating launch angle to range?
Marco: $V^2\sin(2\theta)/g = s_x$

$s_x = V\cos\theta\, t$ $\quad$ $s_y = 1/2gt^2+V\sin\theta t$
level ground $s_y = 0$

$0 = 1/2gt^2+V\sin\theta t$
$0=1/2gt+V\sin\theta$
$t = 2V\sin\theta/g$

$s_x = V\cos\theta \times 2V\sin\theta/g$
recall $2\cos\theta\sin\theta = \sin(2\theta)$

$s_x = [V^2 \sin(2\theta)]/g$

max of sin is at 90º , so max of sin(2θ) is when $2\theta = 90$ so $\theta=45º$

alternately, you can go to projectile sim at Phet and try stuff and see what happens: